Katherine Benjamin

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Education

DPhil, Mathematics (University of Oxford) September 2021 to January 2026

- Thesis title: Topological data analysis for high-dimensional data in biology.
- Research interests: multiparameter persistent homology; single-cell and spatial genomics.
- Supervisors: Prof. Heather Harrington, Prof. Ulrike Tillmann.

MMathCompSci, Mathematics and Computer Science (University of Oxford) 2017 to 2021

- Joint undergraduate/master's degree.
- Distinction, 81% average.
- Specialisation: geometry, topology, formal logic/verification, category theory.

Industry experience

Research Intern (Oxford Asset Management) May 2024 to August 2024

Articles

K Benjamin*, A Bhandari*, JD Kepple, et al. Multiscale topology classifies cells in subcellular spatial transcriptomics. *Nature* 630, pp. 943–949, 2024.

K Benjamin, L Mukta, G Moryoussef, et al. Homology of homologous knotted proteins. *Journal of the Royal Society Interface* 20(201), p. 20220727, 2023.

K Benjamin. Sum-free sets which are closed under multiplicative inverses. *Online Journal of Analytic Combinatorics* 16, 2021.

Book chapters

J Vo-Phamhi & K Benjamin. Syennesis to Aristotle, 2400 Years on: Medicine, Machine Learning, and the Future of Humanities Research. In *Humanities Forward: Opportunity, Innovation, Policy in the 21st Century*, Liverpool University Press (ed. Arlene Holmes-Henderson & Stephan Nitu), 2026.

Awards

STEM for Britain 2024 Silver Medal (Mathematical Sciences)

Talks

Invited talks

Minisymposium on Geometrical and Topological Methods for Data-Driven Modeling, SMB Annual Meeting, Edmonton. July 2025.

CHIMERA Seminar, University College London. April 2024.

Minisymposium on Topological Methods for Data Analysis in Science and Beyond, BAMC 2024, Newcastle. April 2024.

AIM-AMS Special Session on Applied Topology Beyond Persistence Diagrams, JMM 2024, San Francisco. January 2024.

Special Session on Nonlinear Algebra and Its Applications, PGMODays, EDF Lab Paris-Saclay. November 2023.

Minisymposium on Higher Order Networks in Complex Systems, ICIAM 2023, Tokyo. August 2023.

Minisymposium on Algebraic Methods in Biological Systems, SIAM Conference on Applied Algebraic Geometry, Eindhoven. July 2023.

Topology of Data in Rome, Tor Vergata. September 2022.

Contributed talks

Syennesis to Aristotle, 2400 years on: The implications of the machine learning revolution in medicine for the future of humanities research. Humanities Forward: Opportunities and Challenges for the Next Twenty Years, Oxford. Joint with Jenny Vo-Phamhi. May 2023.

Homology of homologous knotted proteins. British Early Career Mathematicians' Colloquium, Birmingham. July 2022.

Internal talks

Multiscale topology classifies cells in subcellular spatial transcriptomics. Spires 2024, Mathematical Institute, University of Oxford. August 2024.

The shape of data: How algebra and topology help us to understand the ways in which our cells organise themselves. Balliol Undergraduate Mathematics Society, Oxford. January 2024.

Multiscale topology classifies and quantifies cell types in subcellular spatial transcriptomics. Mathematics in Biology Day, Max Planck Institute for Mathematics in the Sciences, Leipzig. December 2023.

Persistent homology in theory and practice. Junior Topology and Group Theory Seminar, Oxford. November 2022.

Workshop tutorials

Topological data analysis tutorial. London Geometry and Machine Learning Summer School. July 2022.

Service

Organiser, London Geometry and Machine Learning Summer School 2024

Teaching

Mathematical Institute, University of Oxford

Departmental Tutor

Computational Mathematics	Michaelmas Term 2023
C3.9 Computational Algebraic Topology	Hilary Term 2023

Teaching Assistant

B3.5 Topology and Groups	Michaelmas Term 2022
B1.2 Set Theory	Hilary Term 2022

Software

TopACT: Python package for cell type classification in subcellular spatial transcriptomics.

Pysistence Landscapes: Python package for persistence landscapes in topological data analysis.